Concept for Spray-On Audio-Visual Sensor Array

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Introduction

Demand exists for audio-visual surveillance capabilities which are invisible and are easy and quick to install.

Abstract

Within a transparent spray-on medium, microscopic fibers may be used to act as part of a unified covert imaging system given the following conditions:

Each fiber would have properties that are such that each fiber acts as a receiver for light as well as sound and would be capable of transmitting received data on the EM spectrum with background EM being capable of powering each micro-device which would operate on the principle of burst transmission. Each fiber-shaped device would feature a glass or glass-like optically suitable “droplet” at the bottom that acts as a lens and serves as an anchor that keeps the bottoms of fibers consistently facing downward within the application medium. Glass droplets would also have the benefit of providing a 180 degree field of view. The fibers would be magnetically reactive and would furthermore be designed in such a way that the upper portion of the fibers always point toward magnetic north. In this way, the orientation of each bead and therefore sub-sensor could be assumed to be of a consistent, known value in support of a process of image synthesis that allows data from each fiber to be combined into a single, coherent image.

With each fiber featuring its own 1k pixel sensor within and with the orientation of each fiber accounted for, the relative position of each fiber would then need to be accounted for. This may be accomplished in the following way:

For room surveillance applications, with the fiber-laden medium being applied (by spray-on aerosol) to the ceiling, a single photograph of one wall of a room would be sufficient, when coupled with an A.I. algorithm, to sort out which sensors are closest to the photographed wall and which are farthest away.

As the orientation of each sub-sensor and its position relative to any given wall of the room could then be accounted for, the feeds from each of the sensors could be synthesized in a manner useful for imaging applications without the need to hide surveillance devices in pinholes in ceilings, walls, or within objects, a practice which risks discovery of surveillance equipment. The only visual evidence of the installation of such a surveillance medium would be a glossy, transparent coating on the ceiling of the room(s) in question, visible only under certain lighting conditions and less likely to arouse suspicion than pinholes.

Although each fiber's transmitting power would be limited, the chances of signals arriving at a receiving unit would be increased by varying the length of each fiber, with the length of each fiber, by design, determining both the EM frequency of burst as well as the temporal interval of burst for each fiber. Longer fibers would emit signals at a lower EM frequency but since they accumulate EM energy at a faster rate, would burst at a faster interval, with bursts automatically being triggered by a capacitor reaching maximal charge. This reduces the likelihood of signals from one sub-sensor "stepping on" another. Furthermore, the cost of manufacture is reduced and the efficiency of signal transmission is maximized by forgoing the attachment of specific device IDs to each fiber. Transmissions from each fiber would be differentiated only according to their frequency in order to maximize the percentage of the outgoing signal dedicated to carrying image data and to minimize (or entirely eliminate) metadata from these burst transmissions. The relative position of each fiber would need to be re-evaluated in real-time in order to determine where within the synthesized image to insert data from sub-sensors.

This design puts a larger onus on processors located elsewhere where time and electrical budget are not at issue and a minimal of onus on the sensors themselves, which would then be free to focus on capturing and relaying visual and acoustic information.

Conclusion

Provided approximately 60 seconds of access to the area in question and the ability to place a receiver or string of receivers/relays within the effective transmission range of the imaging medium, all that would be required would be a single photo taken with a digital camera to create a baseline image of one wall of a room, the spray canister of optical transmission fibers, and respiratory protection for the operative coating the ceiling of the room(s) in question in order to safely and effectively establish the surveillance. It should be noted that these fibers, while in an aerosolized state, would pose a likely health risk which must be protected against during installation. Reduced installation times make this approach advantageous in comparison to traditional methods.